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(71) Applicant(s)
Autoliv Development AB
(Incorporated in Sweden)
Patent Department Sweden, S-447 83 Vargarda, Sweden

(72) Inventor(s)
Eric Sandwall

(74) Agent and/or Address for Service
Forrester Ketley & Co
Forrester House, 52 Bounds Green Road, LONDON, N11 2EY, United Kingdom

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B60R 21/16 // B60R 21/20

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US 5957486 A **US 5816660 A**
US 5636861 A **US 5382048 A**

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(54) Abstract Title
An air-bag arrangement for mounting in the dashboard of a motor vehicle

(57) An air-bag arrangement is provided in a motor vehicle. The air-bag is mounted in a recess (13) formed in the dashboard and has a first part (36) and a second part (35). The second part is initially rolled (17) to restrain deployment of the second part until at least a substantial part of the deployment of the first part (36) of the air-bag has been completed. The restraining of the deployment of the second part of the air-bag can be achieved by using adhesive or by a strap with releasing means which is responsive to movement of the first part of the air-bag. The invention also covers a method of folding an air-bag which results in the above arrangement.

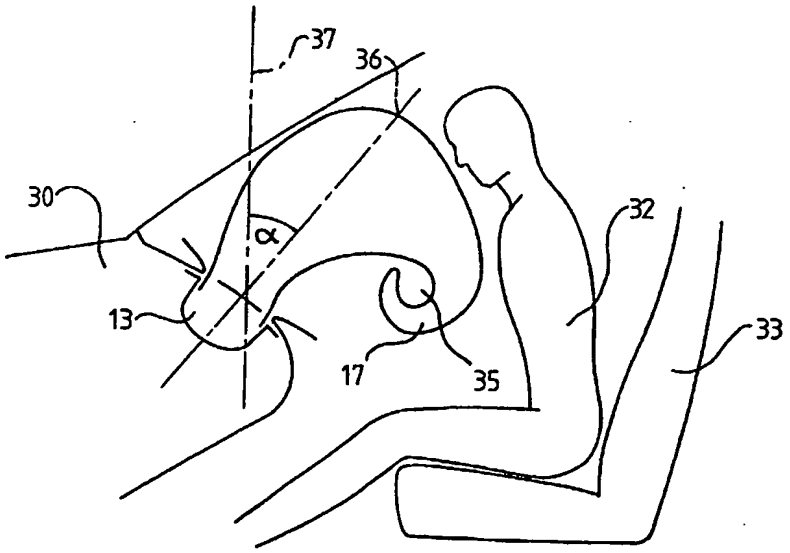

FIG 8

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

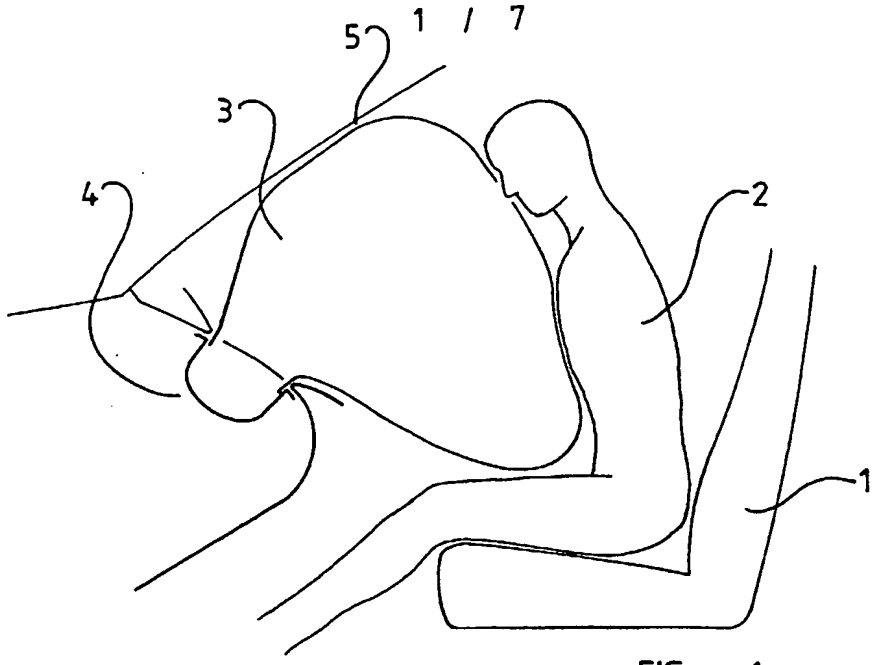


FIG 1

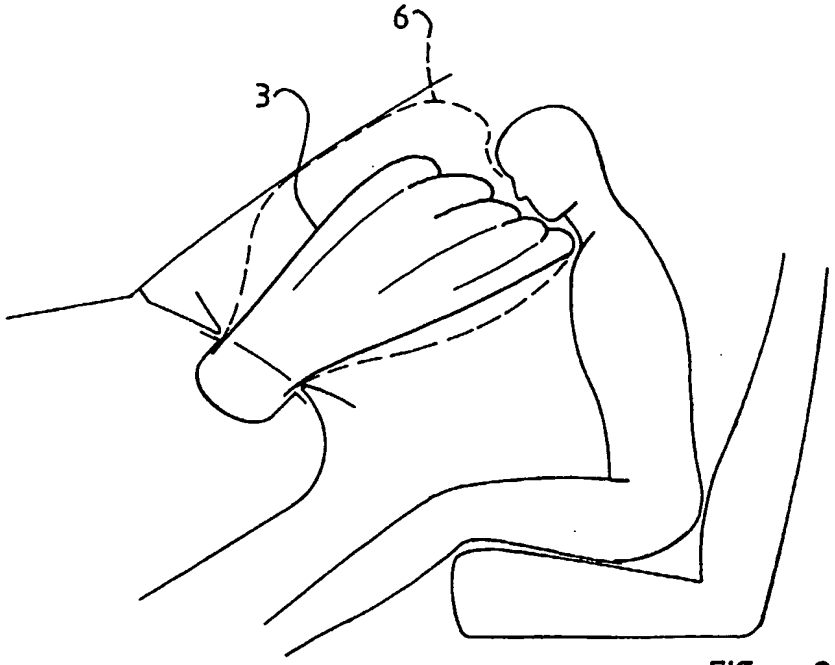


FIG 2

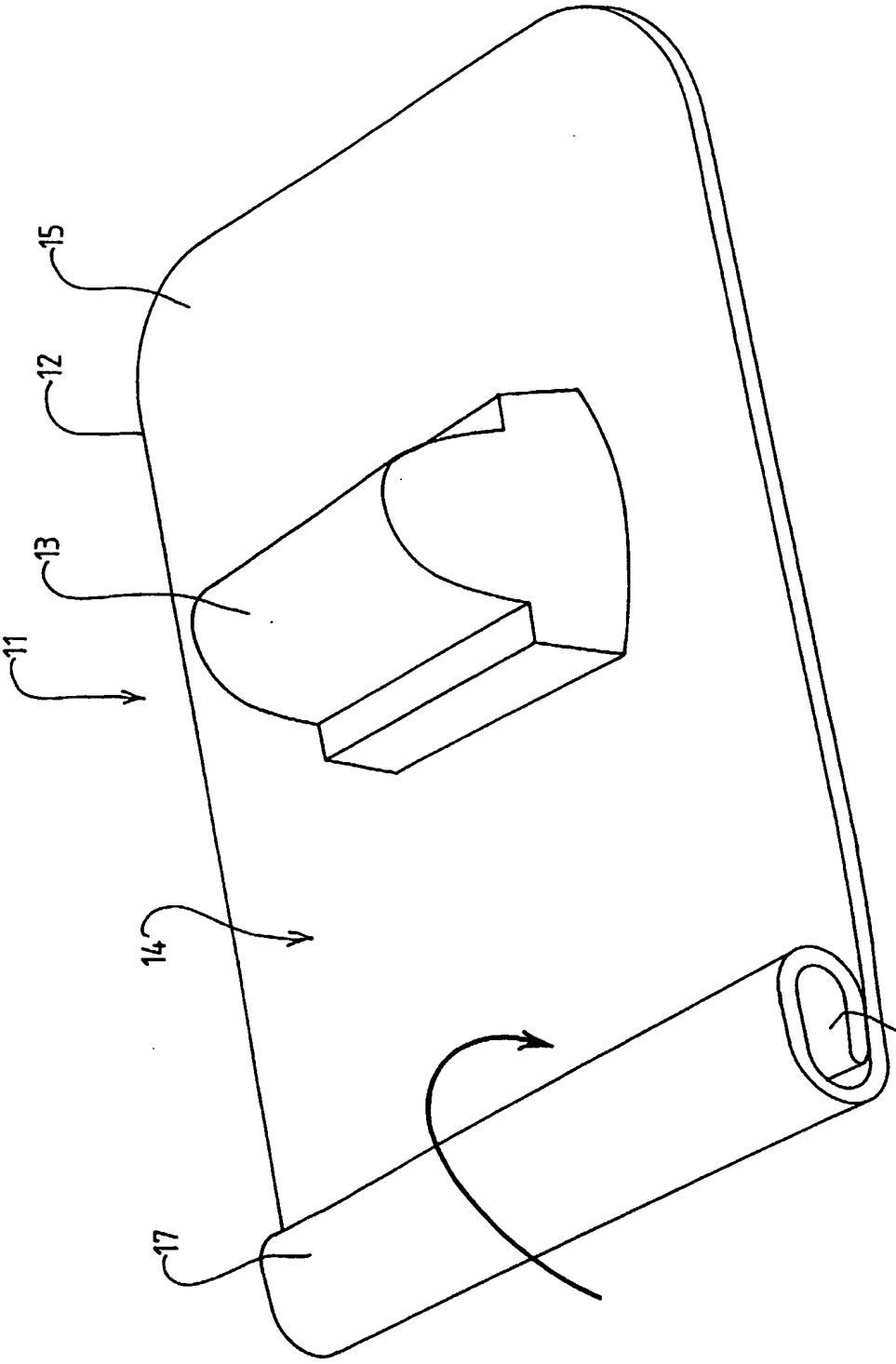


FIG 3

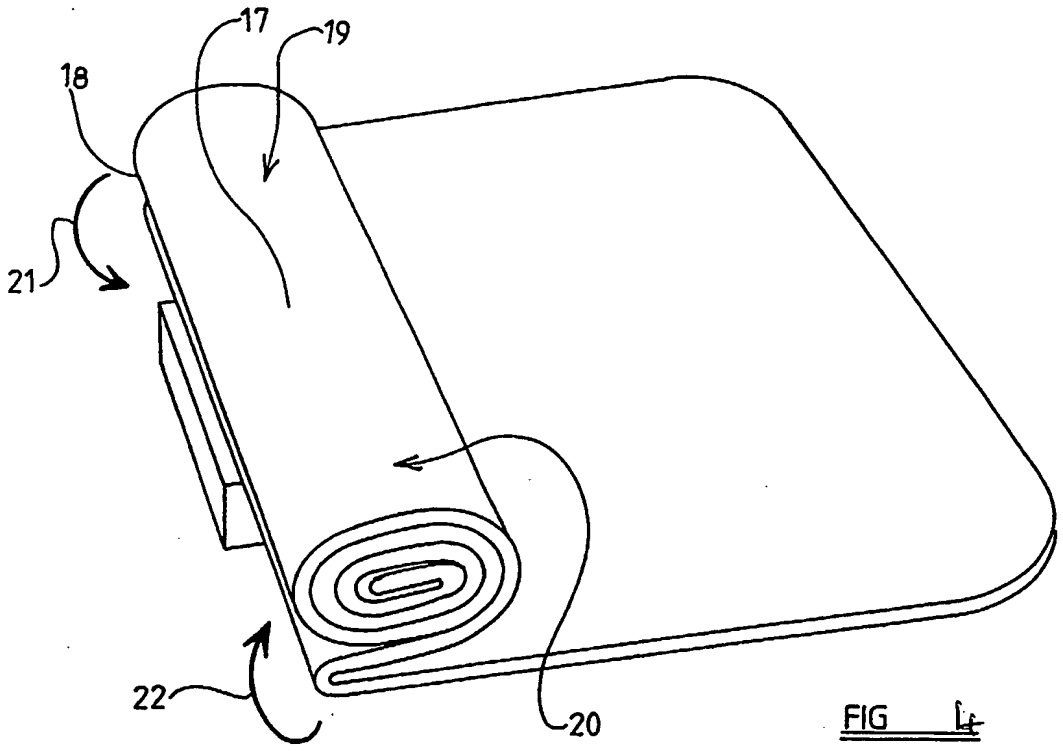


FIG 4

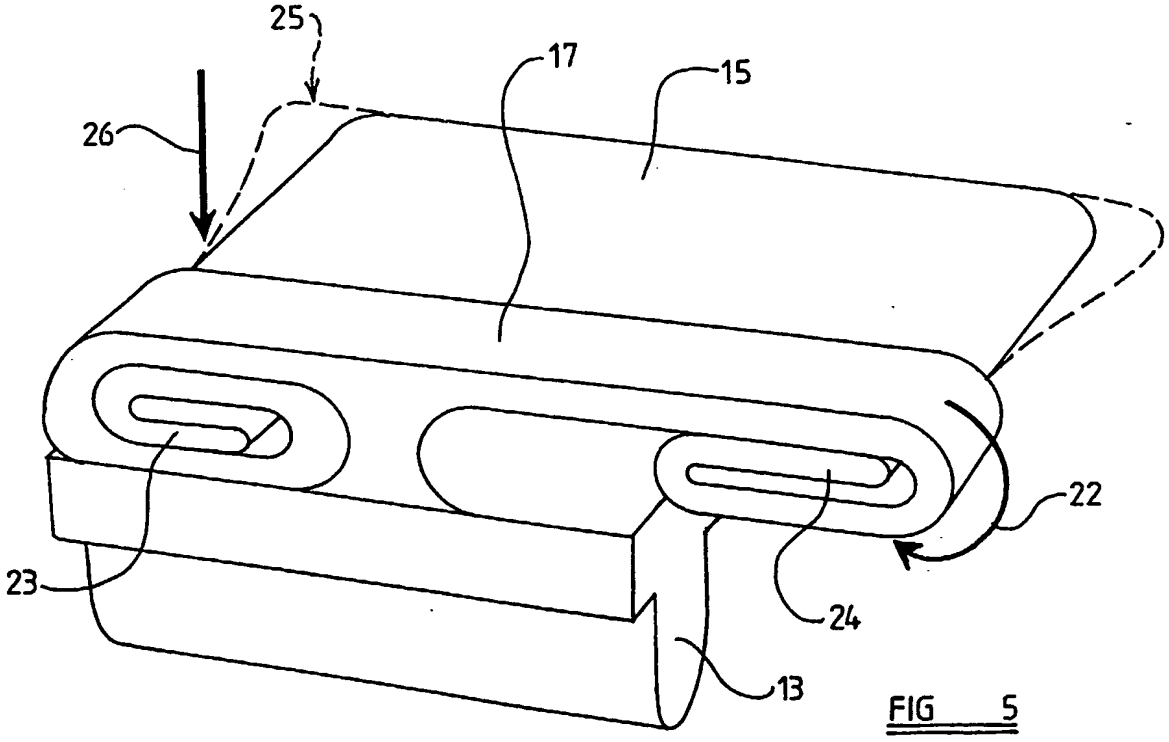


FIG 5

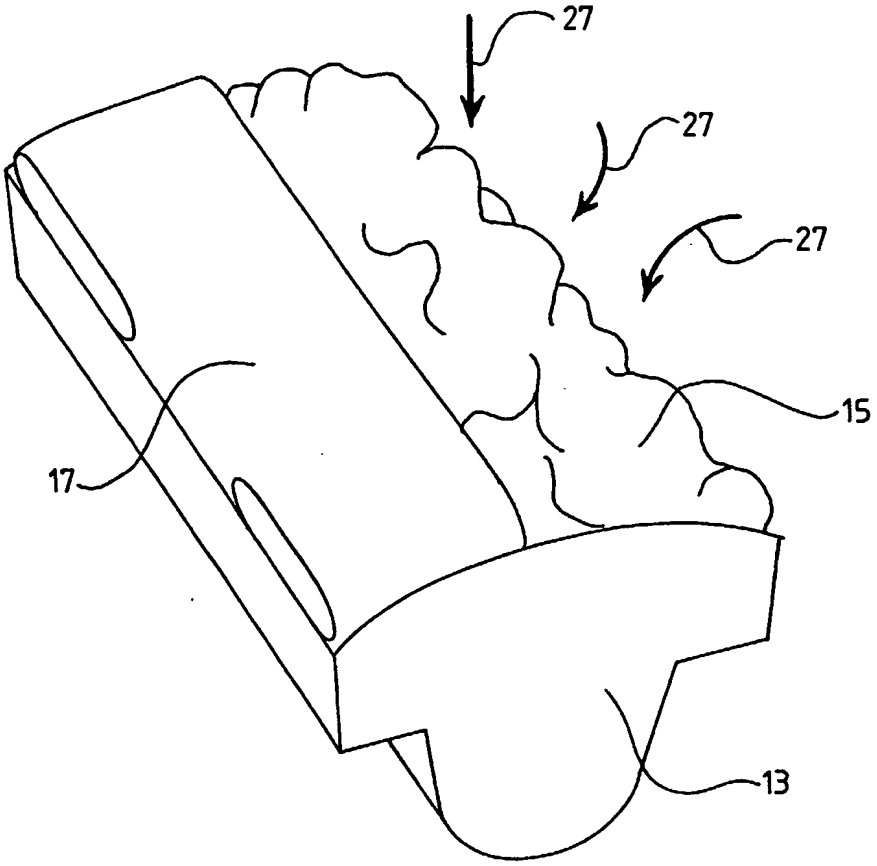


FIG 6

FIG 7

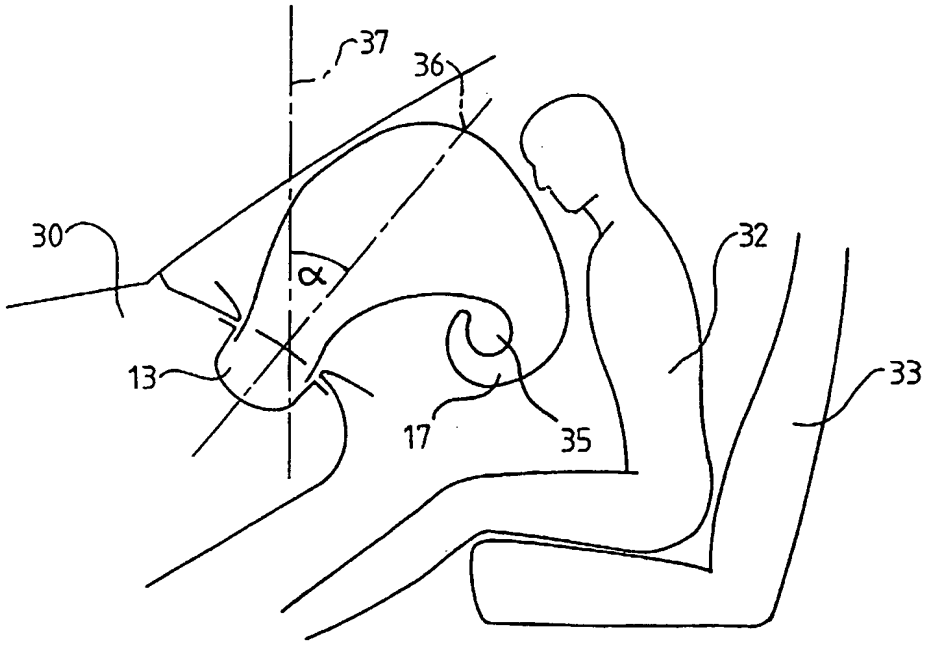


FIG 8

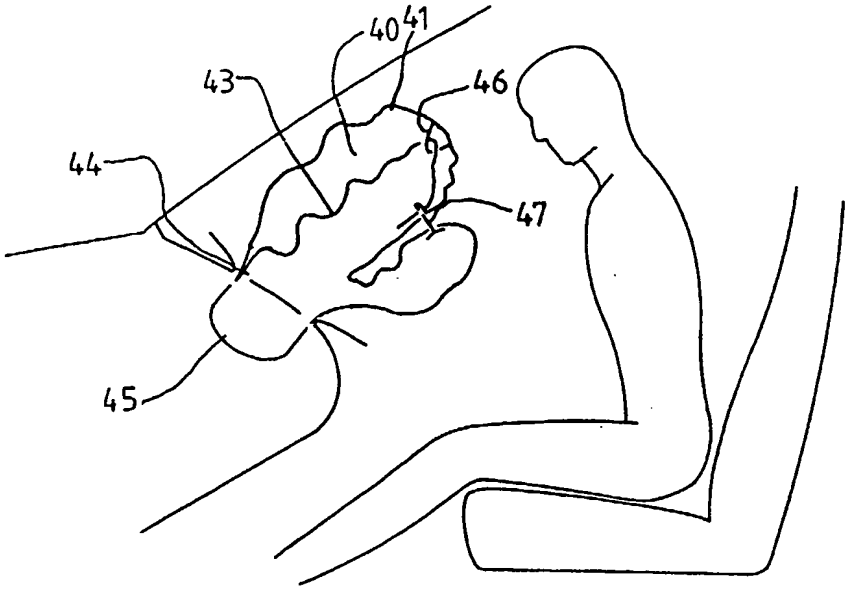


FIG 9

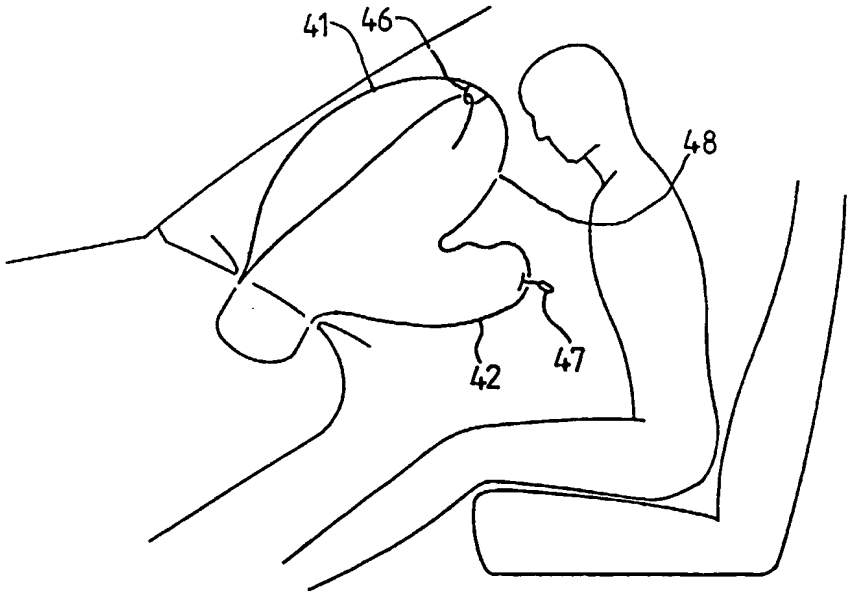


FIG 10

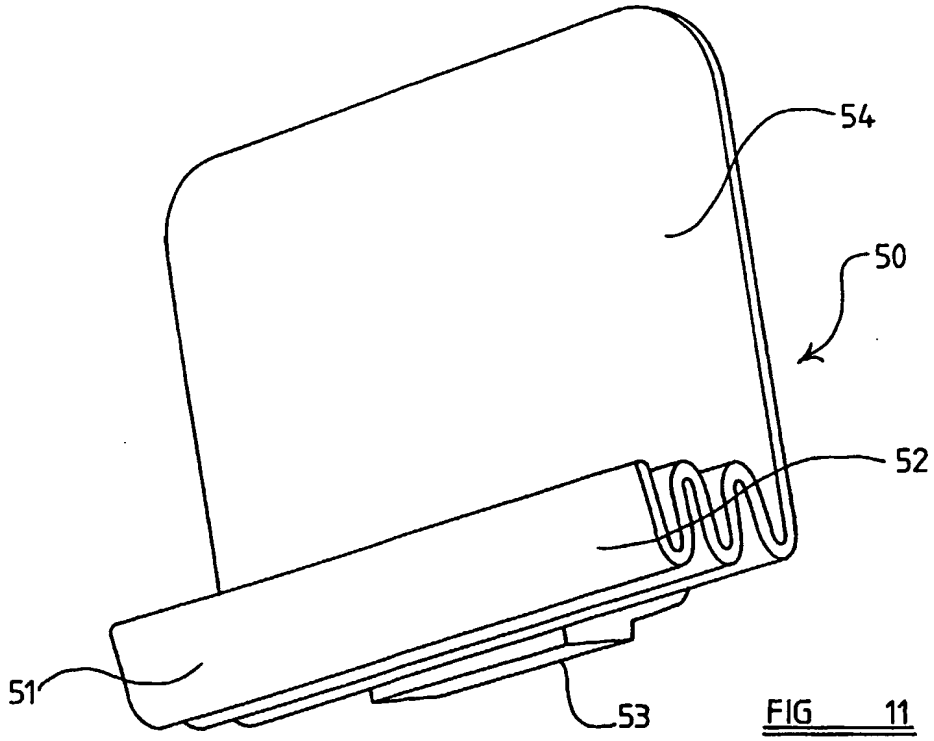
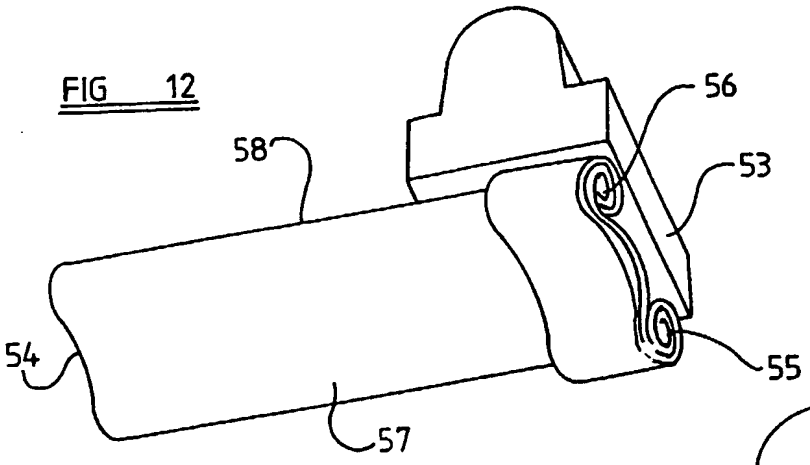


FIG 11

FIG 12



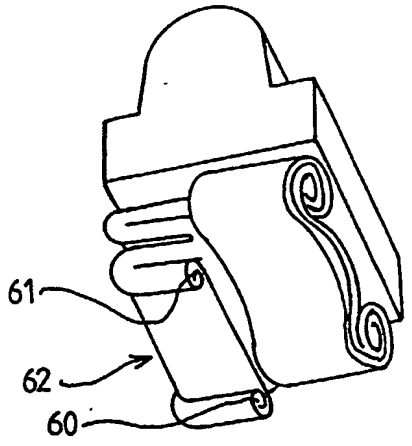


FIG 13

PATENTS ACT 1977

P14718GB-NF/jsd/jw

DESCRIPTION OF INVENTION

"IMPROVEMENTS IN OR RELATING TO AN AIR-BAG ARRANGEMENT"

THE PRESENT INVENTION relates to an air-bag arrangement, and more particularly relates to an air-bag arrangement which is intended to provide protection for the occupant of a front seat of a motor vehicle, such as a front seat passenger.

It is desirable for an air-bag which is to provide protection for the occupant of a front seat of a motor vehicle to inflate in such a way that as soon as possible, after the commencement of inflation, the air-bag presents a substantial volume in front of the occupant of the seat to provide a cushioning effect in the event that the occupant of the seat moves forward and impacts with the partially inflated air-bag. Also, when the air-bag is fully inflated it should be correctly positioned in front of the occupant.

FIGURE 1 of the accompanying drawings, which is a diagrammatic side view of the front part of a motor vehicle during an accident, shows a front seat 1 of a motor vehicle occupied by an occupant 2. An air-bag 3, initially mounted in the dashboard 4 of the motor vehicle is in an inflated condition and is located between the occupant 2 of the vehicle and the windscreen 5. The air-

bag is shown in the desired position which is appropriate for the fully inflated air-bag. The main part of the air-bag is located in front of the head and upper chest of the occupant 2 of the seat 1. A lower part of the air-bag extends towards the pelvic region of the occupant. As the head and upper part of the chest of the occupant move forwardly, as a consequence of deceleration of the vehicle, the inflated air-bag will provide the desired cushioning effect.

It is to be observed that because the air-bag is located within part of the dashboard which is inclined upwardly, it is appropriate for the air-bag to have two sections, one section being intended to extend forwardly and downwardly, thus covering from the upper part of the chest down to the pelvis of the occupant of the seat, and the other section being adapted to extend upwardly to extend towards the windscreen. It has, therefore, been proposed to provide a generally rectangular air-bag, a region between the ends of the bag being connected to the gas generator which is located within an appropriate housing. The gas generator and housing can be considered to divide the rectangular air-bag into two parts, namely an upper part and a lower part. The lower part of the air-bag is typically of greater length than the upper part. The lower part of the air-bag is the part that will engage the chest of the occupant and extend down towards the pelvis, while the upper part will extend upwardly. Typically the upper part and the lower part are symmetrically folded with respective zig-zag folds, and the folded bag is inserted into the housing. The folded bag fits tightly into the housing which is dimensioned to accommodate the air-bag when in the folded state.

When the air-bag is to be inflated, a substantial quantity of gas has to be injected into the air-bag, since the air-bag must be fully inflated within a relatively short period of time.

FIGURE 2 of the accompanying drawings is a view corresponding to Figure 1 illustrating in a solid line a prior proposed air-bag during an initial stage in deployment thereof, and showing in phantom a subsequent stage during deployment of the bag. It is to be observed that the axis of the entire air-bag module is directed upwardly and rearwardly. The air-bag 3 emerges from the housing generally along the line of the axis and thus tends to impact with the occupant 2 in the region of the head and/or the upper part of the chest. Generally, the lower part of the air-bag, which is longer than the upper part, impacts initially with the occupant 2 of the vehicle.

Because the relatively long lower part of the bag may hit the occupant in the region of the upper chest, as shown in Figure 2, there is a possibility that deployment of the lower part of the bag will be impeded due to the shape of the chest of the occupant and due to friction between the air-bag and the occupant. The bag may therefore deploy subsequently only in an upward direction, the bag thus then having a condition such as that shown in phantom 6 in Figure 2. It can be seen that the air-bag, as shown in phantom, is not in the desired position, and does not provide any protection for the lower part of the chest of the occupant.

The present invention seeks to provide an improved air-bag arrangement.

According to this invention there is provided an air-bag arrangement to be mounted in the dashboard of a vehicle to provide protection for an occupant of the vehicle, the air-bag being associated with an inflator adapted to provide gas to inflate the air-bag, the air-bag having respective regions which, on deployment of the air-bag, form an upper part of the air-bag and a lower part of the air-bag, the region forming the lower part of the air-bag being restrained so that, on deployment of the air-bag, at least a substantial part of the deployment

of the upper part of the air-bag occurs before a substantial part of the deployment of the lower part of the air-bag occurs.

In one embodiment the region of the air-bag to form the upper part of the air-bag is scrunched, or chaotically folded. In an alternative embodiment the region to form the upper part of the air-bag is zig-zag folded about a lateral axis at the end of the folding process.

In a preferred embodiment the region of the air-bag to form the lower part thereof is initially rolled or folded about a first axis to form a roll or stack each end of the roll or stack then being folded inwardly towards the centre the roll or stack about a second perpendicular axis.

Preferably the lateral edge zones of the region forming the upper part of the air-bag are inwardly rolled or folded as an initial step in the folding process of the upper part.

In an alternative embodiment the region forming the lower part of the air-bag is provided with adhesive to secure adjacent layers of fabric together to restrain inflation of the region forming the lower part of the air-bag for a predetermined period of time.

In a further alternative embodiment means are provided to restrain inflation of the region having the lower part of the air-bag, there being means to release the restraining means in response to movement of part of the region forming the upper part of the air-bag to a predetermined position.

Preferably the means responsive to movement is a release strap, one end of which is secured to the housing, and which passes through a guide loop mounted on the said part of the region forming the upper part of the air-bag.

Conveniently the region of the air-bag to form the lower part thereof is longer than the region of the air-bag to form the upper part thereof, the housing being connected to the air-bag at a position to separate the two regions thereof.

Advantageously the air-bag arrangement may be mounted in a motor vehicle in a front dashboard, the angle between the axis of the air-bag housing and the vertical axis being less than 45°.

The invention also provides a method of folding an air-bag adapted to provide protection for a front-seat occupant in a motor vehicle, the method comprising the steps of folding or rolling a first region of the air-bag about a first axis to form a roll or stack, folding or rolling the two opposed end regions of the stack about a second axes which are perpendicular to the first axis, and scrunching or chaotically folding the remaining part of the air-bag, and inserting the complete air-bag into a housing.

Preferably the step of folding the first part of the air-bag comprises the step of rolling part of the air-bag from a free end thereof towards the housing to form a roll, the roll having ends which project beyond the housing, and subsequently folding the ends of the roll inwardly.

Conveniently the step of folding the first part of the air-bag comprises the step of zig-zag folding part of the air-bag from a free end thereof towards the housing about a first axis to form a stack, the ends of which project beyond

the housing and subsequently folding the ends of the stack inwards, about second axes perpendicular to the first axis.

Preferably the initial rolling or folding is effected to form a roll or stack on the side of the air-bag from which the housing initially projects, the resultant roll or stack subsequently being folded back to lie over an open part of the housing, and with the ends of the roll or stack being folded inwardly about said second axes to lie beneath the roll or stack before the roll or stack is inserted into the housing.

In order that the invention may be more readily understood, and so that further features thereof may be appreciated, the invention will now be described, by way of example, with reference to the accompanying drawings in which:

FIGURE 1 is a diagrammatic side view of part of a motor vehicle showing a prior proposed air-bag when inflated,

FIGURE 2 is a view corresponding to Figure 1 showing the air-bag of Figure 1 in a partially inflated state,

FIGURE 3 is a perspective view of an air-bag of an air-bag arrangement in accordance with the invention at the commencement of the folding of the air-bag,

FIGURE 4 is another perspective view illustrating a subsequent stage in the folding of the air-bag,

FIGURE 5 is a further view of the air-bag of Figures 3 and 4 illustrating a further stage in the folding thereof,

FIGURE 6 is another view illustrating the air-bag of Figures 3 to 5 during a final stage in the folding thereof,

FIGURE 7 is a diagrammatic view illustrating the air-bag of Figures 3 and 6 at an initial stage during the deployment thereof in a motor vehicle,

FIGURE 8 is a view corresponding to Figure 7 illustrating a subsequent stage in the deployment of the air-bag,

FIGURE 9 is a view corresponding to Figure 7 illustrating a second embodiment of the invention, showing an air-bag at an initial stage during the deployment thereof,

FIGURE 10 is a view illustrating the air-bag of Figure 9 at a subsequent stage in the deployment thereof,

FIGURE 11 is a view of an alternative air-bag arrangement in accordance with the invention during an initial stage in the folding thereof,

FIGURE 12 is a view showing the air-bag of Figure 11 at a subsequent stage in the folding thereof, and

FIGURE 13 shows the air-bag of Figures 11 and 12 at a further subsequent stage in the folding thereof.

Referring initially to Figure 3, an air-bag 11 is illustrated which is an air-bag intended to be mounted in a motor vehicle in a dashboard in front of a front seat occupant within the vehicle. The air-bag 11 is intended to be inflated, in the event that an accident should occur, to provide protection for the occupant of the seat.

The air-bag 11, as shown in Figure 3, is formed of two super-imposed layers of fabric which are inter-connected in the peripheral region 12. The air-bag 11 is of generally rectangular form and is shown, at the beginning of the folding process, stretched out substantially flat upon a horizontal support surface.

The air-bag 11 is shown connected to a housing 13. The housing 13 contains an inflator adapted to supply gas to inflate the air-bag. The housing is connected to the upper layer of fabric. The housing 13 is dimensioned to accommodate the air-bag, when folded, to retain it ready for use.

The housing 13 effectively divides the rectangular air-bag 11 into two regions, namely a first relatively long region 14 located on one side of the housing, and a second relatively short region 15 located on the other side of the housing. The region 14 is adapted, when the air-bag is inflated, to form a lower region located in front of the chest and pelvic region of the occupant of the seat, whereas the relatively short region 15 is intended to be an upper region which extends generally upwardly from the housing 13.

The overall width of the air-bag is greater than the width of the housing.

The housing, the inflator and the air-bag may be of conventional construction.

As can be seen in Figure 1, during an initial stage in the folding of the air-bag, the relatively large rectangular region 14 of the air-bag is folded, from the free end 16 thereof, towards the housing 13. The air-bag may be folded using short linear zig-zag folds or may, as illustrated, be rolled. The folding or rolling is effected so that the resultant folded or rolled air-bag portion, which constitutes a roll 17, is located on the side of the flat air-bag 1 from which the housing 2 projects.

The rolling or folding is continued until the resultant roll 17 lies immediately adjacent the housing 13.

The housing 13 and the relatively small rectangular region 15 of the air-bag 11 are then inverted so that the roll 6 is on the underside of the air-bag adjacent the housing 13. The entire roll may then be folded back about a fold-line 18 which is immediately adjacent the housing 13 so that the air-bag has the condition shown in Figure 4 in which the roll lies across the top of an open mouth of the housing 13 with end portions 19, 20 of the roll projecting beyond the sides of the housing. The end portions 19, 20 of the roll may then be folded downwardly and inwardly, as indicated by the arrows 21, 22. This procedure is illustrated in Figure 5. It can be seen, in Figure 5, that the end 23 of the projecting portion 19 of the roll 17 has been folded inwardly to be in a position overlying the open mouth of the housing 13. The end portion 24 of the projecting portion 20 is shown being folded downwardly and inwardly, as indicated by the arrow 22 to be in an equivalent position.

The downward and inward folding of the projecting end portions 19 and 20 will, of course, effect a similar folding of the side areas projecting relatively small rectangular region 15 of the air-bag. However, the great proportion of the

rectangular region 15 remains unfolded. If desired, at this stage in the procedure, any part of the relatively small rectangular region 15 of the air-bag that is folded, as a consequence of the rolling and folding procedures described immediately above, may be teased out, as shown in phantom 25 so that as great a proportion as possible of the rectangular region 15 remains unfolded.

At this stage the roll 17, with the inwardly folded end portions 19 and 20, overlies the housing 13 and may be pressed downwardly into the housing as indicated by the arrow 26. This leaves the relatively small rectangular region 15 extending outwardly away from the housing.

As a final step in the folding process, the relatively small rectangular portion 15 is simply "scrunched" up or folded chaotically and forced into the housing in a random or loose compressed manner, as indicated by the arrows 27 in Figure 6.

A cover may be placed on the housing and the housing may then be mounted in position, for example in the dashboard of a motor vehicle.

It is to be appreciated that the relatively large rectangular region 14 is tightly folded by initially being rolled in one direction, with the ends of the roll then being folded or tucked downwardly and inwardly. Thus this first relatively large rectangular region 14 of the air-bag is initially rolled about one axis and then has the end parts folded about a perpendicular axis. This folding provides a tightly folded region which is restrained from immediate inflation when gas is injected into the air-bag. However, the relatively small rectangular region 15 is not tightly folded with regular folds, but instead is simply "scrunched" up or chaotically folded and forced into the housing in such a way that gas from the inflator may readily flow to all regions of that uninflated part

of the air-bag, thus effecting a substantially uniform inflation of that part of the air-bag.

Figure 7 illustrates a housing 13 provided with an air-bag 11 folded in the manner described above with that housing 13 mounted in the dashboard 30 of a motor vehicle 31. The dashboard is located in front of an occupant 32 of a front seat 33 who is to be protected by the air-bag 11. Figure 7 shows the condition of the air-bag shortly after inflation thereof has commenced.

At the beginning of the inflation of the air-bag, gas from the inflator is introduced to the interior of the air-bag. Because the relatively small rectangular region 15 of the air-bag has only been "scrunched" or chaotically folded and forced into the housing, there is a relatively large part of this region of the air-bag that is in fluid flow communication with the gas generator. Gas is not prevented from passing from flowing in this region of the air-bag by folds effected between two adjacent layers of fabric, which folds tend to shut off completely the flow of gas. Instead the gas can flow relatively freely into the interior of a substantial portion of the relatively small rectangular region 15 of the air-bag, and this region 15 inflates rapidly and substantially uniformly to form zone 34 as shown in Figure 7. The zone 34 is shown at the top of the air-bag, as it inflates. Zone 34 tends to draw the folded roll 17 out of the housing 2 with that folded roll being located at the lower part of the air-bag. The inflated zone 34 will provide some protection for the occupant if the occupant impacts with the air-bag at this stage of inflation. At this stage a substantial part of the deployment of the upper part of the air-bag has been effected before deployment of the lower part of the air-bag has commenced.

The next stage during the inflation of the air-bag is shown in Figure 8. The side rolls 22 and 23 are initially unrolled. These side rolls need to be un-

rolled before the folded roll 17 can unroll as the side rolls 22 and 23 hold the folded roll 17 in position. Thus the side rolls 22 and 23 act to delay the unrolling of the roll 17 so that the roll 17 only unrolls when deployment of the upper part of the air-bag is substantially complete. The folded roll 17 then begins to un-roll, as shown at 35, thus extending towards the pelvic region of the occupant 32. The roll 17 unrolls smoothly. The roll 17 is not the first part of the inflating air-bag to engage with the occupant, and so the risk of the roll being engaged and retained by the upper part of the chest of the occupant is reduced or obviated.

It is to be observed, from Figures 7 and 8, that the axis 36 of the air-bag 13 as mounted in the dashboard 30, makes an angle α with the vertical 37. The angle α is less than 45° and in this embodiment is 35°.

The air-bag has an inflation characteristic which is such that there is a minimal risk of the air-bag impacting with the occupant of the vehicle in such a way as to injure the occupant, as the zone 34 will inflate uniformly, due to the scrunching rather than folding, as no part of that zone is given an especially high acceleration during inflation. Also the inflated zone 34 is present very shortly after inflation commences, and is able to provide some protection for the occupant.

Whilst, in the embodiment described with reference to Figures 3 to 8, deployment of the lower part 14 of the air-bag is restrained until at least a substantial part of the axial deployment of the upper part 15 of the air-bag has taken place, by folding the lower part 14 in a relatively tight manner, whilst only scrunching or loosely folding the upper part 15 of the bag, the same end effect may be achieved in other ways. It is contemplated, for example, that the lower part of the bag may have an exterior coating of a tacky or adhesive

material, so that, when folded, adjacent parts of the air-bag will adhere to each other. The lower part 14 of the bag will therefore be resistant to inflation, since the adjacent layers of fabric will be adhered together by the sticky material or adhesive. The upper part 15 of the air-bag would not be provided with the adhesive, thus facilitating swift inflation of the upper part 15 of the air-bag as compared with the inflation of the lower part of the air-bag.

It is envisaged that in a further modified embodiment of the invention, a tear-seam could be utilised, but the breaking of an internal tear-seam may be dependent upon the internal pressure which can vary as a function of temperature. Thus, in an alternative embodiment of the invention as illustrated in Figures 9 and 10, the folds of the lower part are restrained in such a way that the folds of the lower part may be released by a strap connected to the fabric of the upper part of the bag.

Thus, as shown in Figure 9, an air-bag 40 is provided, which can be very similar to the basic air-bag 11 shown in Figure 3, the air-bag 40 having an upper region 41 and a lower region 42. A release strap 43 is provided having one end thereof 44 secured to the housing 45 in which the air-bag is initially provided. The release strap 43 passes through a guide loop 46 which is secured to part of the fabric forming the upper region 41 of the air-bag. The other end of the release strap 43 passes through a loop 47 which is secured to the exterior of the lower region 42 of the bag and enters into the upper region 41 of the bag through a small aperture 48 (see Figure 9). The end of the release strap 43 remains in the loop 47 securing part of the exterior of the lower region 42 of the bag to the exterior of the upper region 41 of the bag so as to prevent or restrain full deployment of the lower region 42 of the bag. The release strap 43 has such a length that during the initial stages of inflation of the air-bag the release strap 43 is loose, as shown in Figure 9. However, as the upper part 41

of the air-bag becomes fully inflated, as shown in Figure 10, tension is applied, by the guide loop 46, to a release strap 43, thus withdrawing the end of the strap 43 from the loop 47, permitting the loop 47 to be withdrawn through the aperture 48 to the lower region 42 as the bag inflates. Full inflation of the lower part 42 of the air-bag is thus able to commence. Thus in this embodiment, it is the upper part of the air-bag that is initially inflated to engage the occupant, inflation of the lower part being restrained until a moment when deployment of the upper part of the air-bag has been substantially completed.

Figure 11 illustrates an alternative method for folding an air-bag which has some similarities to the method described above, with reference to Figures 3 to 6.

Figure 11 illustrates an intermediate stage in the folding of an air-bag 5[illegible] which is generally similar to the air-bag 11 shown in Figure 3. The air-bag 5[illegible] has a first relatively large lower region 51 which is shown, in Figure 11, folded with a zig-zag folding to form a stack 52 located adjacent a housing 53 into which the air-bag is to be folded. The stack 52 is therefore generally equivalent to the roll 17 of Figure 4.

The air-bag shown in Figure 11 has a second relatively small rectangular region 54 which extends away from the housing 53.

In a subsequent folding stage, as shown in Figure 12, the ends of the stack 51 are folded downwardly and inwardly, with a folding movement equivalent to that indicated by the arrows 21 and 22 of Figure 4, to form inwardly directed coils 55, 56 adjacent an open mouth of the housing 53. During this procedure, the side edge parts 57, 58 of the rectangular region 54 will also become rolled to form rolled side edge "beads" 60, 61. The

rectangular region 54 with the side beads 60, 61, may finally be folded with a zig-zag folding to produce a folded stack 62. The folded air-bag may then be moved into the housing 53.

It is to be appreciated that because the ends of the stack 52 are rolled inwardly to form the rolls 55, 56 after the zig-zag folding of the stack, the effect of the inwardly rolled ends is to initially restrain inflation of the lower rectangular part of the air-bag 50. On the other hand, because the zig-zag folding of the relatively small rectangular part 54 is effected after the rolling that creates the beads 60, 61 at the edges of that region, the presence of the beads does not restrain inflation of that particular part of the air-bag. Thus, when the air-bag illustrated in Figures 11 to 13 is deployed, initially the upper part of the air-bag 54 will be extended, with an un-folding of the zig-zag folds, and then that part of the air-bag will inflate, with the beads 60, 61 gradually un-rolling. During the final stages of deployment of the air-bag, the lower region 51 of the air-bag will become inflated.

Thus, in the described embodiments of the invention, each air-bag possesses a desirable inflation characteristic with the upper part of the air-bag being initially inflated, and with the lower part of the air-bag being inflated subsequently. Thus, it is envisaged that in ordinary deployment of the air-bag, the upper part of the air-bag will be inflated to provide some degree of protection for the occupant before the lower part starts to inflate. The risk of the lower part engaging the upper chest of the occupant, and subsequently failing to move to the desired position in front of the chest and pelvic region of the occupant is obviated or reduced.

In the present specification "comprise" means "includes or consists of" and "comprising" means "including or consisting of".

The features disclosed in the foregoing description, or the following Claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

CLAIMS:

1. An air-bag arrangement to be mounted in the dashboard of a vehicle to provide protection for an occupant of the vehicle, the air-bag being associated with an inflator adapted to provide gas to inflate the air-bag, the air-bag having respective regions which, on deployment of the air-bag, form an upper part of the air-bag and a lower part of the air-bag, the region forming the lower part of the air-bag being restrained so that, on deployment of the air-bag, at least a substantial part of the deployment of the upper part of the air-bag occurs before a substantial part of the deployment of the lower part of the air-bag occurs.

2. An air-bag according to Claim 1 wherein the region of the air-bag to form the upper part of the air-bag is scrunched, or chaotically folded.

3. An air-bag according to Claim 1 wherein the region to form the upper part of the air-bag is zig-zag folded about a lateral axis at the end of the folding process.

4. An air-bag arrangement according to any one of the preceding Claims wherein the region of the air-bag to form the lower part thereof is initially rolled or folded about a first axis to form a roll or stack, each end of the roll or stack then being folded inwardly towards the centre of the roll or stack about a second perpendicular axis.

5. An air-bag according to Claim 4 wherein the lateral edge zones of the region forming the upper part of the air-bag are inwardly rolled or folded as an initial step in the folding process of the upper part.

6. An air-bag arrangement according to any one of Claims 1 to 3 wherein the region forming the lower part of the air-bag is provided with adhesive to secure adjacent layers of fabric together to restrain inflation of the region forming the lower part of the air-bag for a predetermined period of time.

7. An air-bag arrangement according to any one of Claims 1 to 3 wherein means are provided to restrain inflation of the region forming the lower part of the air-bag, there being means to release the restraining means in response to movement of part of the region forming the upper part of the air-bag to a predetermined position.

8. An air-bag arrangement according to Claim 7 wherein the means responsive to movement is a release strap, one end of which is secured to the housing, and which passes through a guide loop mounted on the said part of the region forming the upper part of the air-bag.

9. An air-bag according to any one of the preceding Claims wherein the region of the air-bag to form the lower part thereof is longer than the region of the air-bag to form the upper part thereof, the housing being connected to the air-bag at a position to separate the two regions thereof.

10. An air-bag arrangement according to any one of the preceding Claims when mounted in a motor vehicle in a front dashboard, the angle between the axis of the air-bag housing and the vertical axis being less than 45°.

11. A method of folding an air-bag adapted to provide protection for a front-seat occupant in a motor vehicle, the method comprising the steps of folding or rolling a first region of the air-bag about a first axis to form a roll or stack, folding or rolling the two opposed end regions of the stack about a second axes

which are perpendicular to the first axis, and scrunching or chaotically folding the remaining part of the air-bag, and inserting the complete air-bag into a housing.

12. A method according to Claim 11 wherein the step of folding the first part of the air-bag comprises the step of rolling part of the air-bag from a free end thereof towards the housing to form a roll, the roll having ends which project beyond the housing, and subsequently folding the ends of the roll inwardly.

13. A method according to Claim 11 wherein the step of folding the first part of the air-bag comprises the step of zig-zag folding part of the air-bag from a free end thereof towards the housing about a first axis to form a stack, the ends of which project beyond the housing and subsequently folding the ends of the stack inwards, about second axes perpendicular to the first axis.

14. A method according to any one of Claims 11 to 13 wherein the initial rolling or folding is effected to form a roll or stack on the side of the air-bag from which the housing initially projects, the resultant roll or stack subsequently being folded back to lie over an open part of the housing, and with the ends of the roll or stack being folded inwardly about said second axes to lie beneath the roll or stack before the roll or stack is inserted into the housing.

15. An air-bag arrangement substantially as herein described with reference to and as shown in Figures 3 to 8 of the accompanying drawings.

16. An air-bag arrangement substantially as herein described with reference to and as shown in Figures 9 and 10 of the accompanying drawings.

17. An air-bag arrangement substantially as herein described with reference to and as shown in Figures 11 to 13 of the accompanying drawings.

18. A method of folding an air-bag substantially as herein described.

19. Any novel feature or combination of features disclosed herein.

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Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): B7B (BSBCC, BSBCR)

Int Cl (Ed.7): B60R 21/16, 21/20

Other: Online WPI, EPODOC, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X,Y	US 5957486 A	(TAGUCHI et al.) See all Figs and column 1 line 13 to column 2 line 18.	X:1,3,5,11 Y:2,4
Y	US 5816660 A	(JOHNSON, III, et al.) See Figs 10 and 12.	2
X,Y	US 5636861 A	(ORSULAK et al.) See Figs 4, 5 and 8.	X: 1,3,11 Y: 2,4
Y	US 5382048 A	(PAXTON et al.) See Figs.2, 16 and 18.	4

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
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